In the Specification

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More recently, however, open systems have become popular particularly with advances in networking and hardware capabilities. Open systems generally make copies on a file-by-file basis where one logical volume is involved. However, they do not have commands with the capability of handling data on a track-by-track basis. In recent times, the need for making single or multiple copies essentially independently of normal processing has become more desirable even in open systems. Moreover, it has become desirable to transfer entire logical volumes, and even to copy a subset, because in open systems logical volume transfers can actually occur more quickly. This feature exists because it is not necessary to incur the overhead of finding data blocks associated with a single file which can be at any arbitrary position in a logical volume.

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Assume the HOST APP A application 22 processes data in the logical device 36A and, as a requesting host application, could then determine a need to transfer a copy of the data in logical device 36A to logical device 40A for use by another application, such as the HOST APP B application 23. Obviously the logical device 40A must have a capacity that is at least the capacity of logical device 36A. A special copy command (e.g., a FILE SMMF command) contains arguments that identify the logical devices 36A and 40A as source and destination

logical devices respectively. Both logical devices can be identified by any known conventional procedures.

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When a requesting host application in ~~a mainframe~~ an open system seeks to copy the data from the logical device 36A to the storage locations in logical device 40A, for example, the requesting host application initiates a process 90 including step 91 in FIG. 4 to interact with the data storage facility 24, particularly the host adapter controller and the device controller associated with the source, such as the controller 86 in the host adapter 26 and the controller 87 in the disk adapter 30 that is designated a source logical device. Step 94 begins a process for creating a session ID. Specifically, a host adapter controller, such as the controller 86 in the host adapter 26, transfers control to step 95 to establish and populate the data structure 70 of FIG. 3. Step 96 then establishes a session ID number. More specifically, there is associated with each Track ID Table a data block for containing protection bits. The data block can be considered as a two-dimensional array with one row for each track and one column for each session. In the Symmetrix disk array storage systems, each row is 2 bytes wide to define up to 16 sessions. This array is located as PB header 96 on each Track ID table. In the following discussion a particular PB bit position will be identified in the form PB(x,y) where x indicates a track in a cylinder and y indicates a session number. During the session creation in step 95, the controller 87 determines whether any

"y" column is available. If one is available, the controller 87 establishes a session identification correlated to the selected PB bit column. This assignment is applied to each PB header 96 associated with the source and destination devices. Establishing separate sessions enables multiple copying operations to be processed in parallel even with overlapping areas. For example it is possible to copy the data from the logical volume 36A to the destination logical device 40A and to copy the data in logical device 36B to the destination logical device 41A by establishing a separate session.

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The data storage facility 24, and particularly the destination device controller 88, responds to establish the environment and ~~initiate~~ initiates the copy operation all as shown in FIG. 5. Once this process is completed, a status is returned to the requesting host application. Step 122 in FIG. 4 receives the status and enables the requesting host application to continue its operation, that may include generating a complete message or initiating the second, or "copy" operating phase.

When the host adapter in the data storage facility 24, such as the host adapter 26, receives an establish system call, the destination device controller, such as the ~~destination device~~ controller ~~88~~ 86, receives that system call and verifies various parameters in step 123 of FIG. 5. Such verification

might include determining that the logical device identification is valid and the same address as might be recorded in the device header. Any of a number of other tests may also be performed to verify the context and content of the system call.

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Control then passes to a procedure 127 shown in FIG. 6. If the destination device has mirrored physical devices, a procedure, not described in detail, but known in the art, assures that all the related mirror devices are inactive. In an open system, control transfers to step 131. For each track in the destination device, step 131 performs a number of functions. First, it uses the values in the header 61 to determine that the header 61 is associated with a destination logical device and that an indirect (IND) bit position 132 in each track associated with the destination device is cleared. Then, for every destination track, step 131 sets that IND flag and sets an indirect address, that is the address of the track in the source logical device to be copied, to a cache pointer. If there are any pending write operations to the device, they are cleared. More specifically, this implementation of the invention assumes that the requesting host application will take no action to destroy data integrity. With this assumption, any write pending operations are irrelevant because they would be replaced by the copied file. Clearing the write pending flag assures that no such data will overwrite the

copied file track. Any in-cache (IC) flag 133 that is set in each destination track is cleared. ~~At this point the system may set a write pending bit to effect a transfer of the extents track to the source device 31.~~